Monthly credit from and deposits in Swedish commercial banks, 1875–2020

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Since the global financial crisis in 2008, there has been an elevated interest in private debt and as a macro-economic variable. In light of the lack of high-frequency data, this study presents a unique monthly time series dataset on credit from and deposits in Swedish commercial banks from 1875 to 2020, covering 1,752 monthly observations and most of Swedish commercial banking history. In a first application, the study examines to what extent money in Sweden has been exogenous, created independently of demand by the central bank, or endogenous, created in response to demand by commercial banks, during different institutional settings. The results, derived via cointegration and impulse-response functions, show that though the relationship between deposits and credit has changed over time, both theories often hold validity simultaneously. While changes in deposits often have had significant impact on credit, the opposite has also been true. There are, however, differences between different regulatory regimes, as well as for different groups of banks.

Since the global financial crisis (GFC) in 2008, the level of private debt has gained much attention as an indicator of macroeconomic stability. Several studies have found it to be an important indicator of financial crises (Kindleberger 1978; Bordo and Meissner 2012; Jordà *et al.* 2013). The availability of long monthly time series is, however, limited. To the best of this author's knowledge, this study presents the longest monthly time series dataset on credit and deposits in the world – on commercial bank credit to and deposits from the general non-bank public, in Sweden from 1875 to 2020. Altogether the dataset covers 146 years of Swedish banking history and comprises 1,752 monthly observations.

There has also been a renewed interest in the causes of increased private debt levels, not least the responsibility of banks for credit expansion and their ability to create money as credit 'out of thin air' (e.g. McLeay *et al.* 2014; Sierón 2019). In a first application of the data presented here, this study examines to what extent money in

Sweden during this period has been exogenous, created independently of demand by the central bank, or endogenous, created in response to demand by commercial banks in competition. Thus, the second aim of the article is to shed light on a central yet controversial issue which has remained unsettled for centuries.

The next section is a literature review, on earlier research and theory. Section II consists of a short historical account of the institutional setting for Swedish commercial banks. Section III describes the sources and the data compilation, while the methodology used is described in Section IV. Section V presents the results of these econometric tests, and Section VI is a concluding discussion. The study also contains an appendix with further details of the methodology used.

<div align="center">I</div>

There are plenty of data on credit, deposits and monetary aggregates, both nationally and in international compilations. As with economic data in general, however, the further back in history, the scarcer the data. The richest and most long-term annual time series on money and private credit is found in the Jordà–Schularick–Taylor Macrohistory Database (Jordà *et al.* 2017), an unbalanced panel covering 18 countries from 1870 to 2017. For Sweden, there are annual data on credit from banks and mortgage institutions to the non-bank public since 1900 in Ahnland (2015), and annual data on both credit and deposits for individual commercial banks from 1866 to 1994 in Häggqvist *et al.* (2019, 2020).

The most comprehensive long-term quarterly time series dataset is that of the Bank for International Settlements' (2021) statistics on credit to the non-financial sector, also an unbalanced panel with data, covering several credit categories for 43 countries from the third quarter since 1940 to the third quarter 2021. There are also some national long-term datasets with monthly data on money aggregates. For example, Bank of England (2017) has monthly data on monetary aggregates in the United Kingdom from 1870 to 2017 and monthly data on lending from banks for the United Kingdom since 1921 to 2017. Metcalf *et al.* (1998) have monthly data on monetary aggregates, but not on credit, for Canada from 1871 to 1967.

The debate on whether money is exogenous or endogenous has been ongoing since the clash between the Currency School and the Banking School during the nineteenth century and even before that (Arestis and Moore 2001). During the twentieth century the neoclassical synthesis argued for the exogenous position, while particularly post-Keynesians (Sierón 2019) argued for the opposite – although an endogenous view was also held by other notable scholars, not least Schumpeter (1934, pp. 114–15) and Wicksell (1898 [1962]). The exogenous money view is that deposits cause credit, as economic agents deposit their savings with banks, which in turn lend it to others. In this scenario banks are mere financial intermediators. The money supply is here imposed exogenously by the government, mostly the central bank.

Proponents of the endogenous view on the other hand note that banks create deposits when they grant a loan. The fact that deposits created may leave the bank for another bank shortly after they are created forces banks to look for funding. This is done mainly via either previous deposits or the clearing function of the interbank market. In the latter case it enables a banking system collectively to expand both credit and deposits. This process is, however, restrained by reserve requirements, whether voluntary but customary or mandatory by regulation. A fixed deposit-to-reserve ratio applies a 'speed limit' to bank money creation, making money creation exogenous – beyond the influence of market forces. Countering this argument, the endogenous view claims that reserves may fluctuate. For instance, according to Wicksell (1898 [1962]), when the market interest rate is lower than the 'natural rate' (the rate equating long-term demand for, and supply of, capital) investors borrow more, so that commercial banks reduce their preferred reserves and the money supply increases.

Reckless lending is ultimately bad for business and will drive up funding costs for a bank, but short-term market mechanisms may cloud long-term risk-assessment. For instance, even if a bank may be prudent when it comes to demands on collateral, collateral in assets such as stocks and real estate fluctuates and has historically been prone to speculation. Moreover, access to credit may inflate (or deflate) asset prices, creating mutual feedback between credit and collateral. Minsky (1992) has demonstrated how lending and borrowing may become increasingly risky and speculative over a financial cycle. Furthermore, competition/concentration on the banking market may affect access to and the price of credit (Bonaccorsi di Patti and Dell'Arricia 2004), and booms and busts may have an impact on the degree of competition.

Scholars have also questioned the exogenous–endogenous dichotomy altogether, arguing that money is neither completely one or the other (Chick and Dow 2002; McLeay *et al.* 2014; Sierón 2019), and that the degree to which it is exogenous or endogenous is contingent on a changing institutional setting (e.g. Chick 1992, pp. 193–205; Niggle 1990; Sirerón 2019). As Chick (1992, pp. 193–205) points out in her evolutionary approach to the English banking system, increasing bank branching and clearing arrangements during early banking history turned deposits increasingly from being stores of value into transactions balances. Money, Chick argues, was however still largely exogenous at this early stage, not least since bank notes and deposits were convertible to gold or silver specie, the supply of which was largely exogenous. At the same time, however, reserve requirements were often subject to the demand for credit and the prudence, or lack thereof, of bankers (Niggle 1990). Capital requirements also have an impact on the risk-taking and lending of the banks, as does the amount of both non-deposit liabilities and non-loan assets of differing maturity and liquidity.

As financial regulation toughened over the course of the twentieth century, the ability by the banks to create money also became restrained. Interest rate regulation, capital controls and credit rationing imposed by government all contributed to this. Consequently, as those regulations eased internationally particularly during the

1970s and 1980s (e.g. Forsyth and Notermans 1997), money creation by banks eased too. For instance, competing banks increasingly came to attract non-depository assets of institutional investors, creating new deposits, reserves and lending capacity (Chick 1992, pp. 193–205). More so, financial innovation in the form of liability and asset management techniques allowed banks to increase their lending for any given reserve requirement (Niggle 1990). Additionally, as central banks accepted responsibility for a stable financial system, a potential for extending lending beyond the reserve capacity of the banking system emerged. Thus, money became increasingly endogenous over time.

<center>II</center>

It is important to choose consistent criteria when making a periodisation. One such criterion in the current setting is financial regulation, an important aspect of the institutional framework for banking. The present study is based on Larsson and Söderberg (2017, p. 9), who have identified three main regimes of financial regulation in Sweden during the twentieth century – the Classical regime until about 1950, the Statist regime until about 1980, and the Market regime after that. Larsson and Söderberg also distinguish between subperiods within these regimes. Arguably, their most relevant distinction within the Market regime is between the deregulatory era until about 1995 and the period after that. This periodisation will also be used in the present study. The 1950–5 and 1955–60 subperiods they identify during the Statist regime are considered too short for the study. Since the present study precedes their study, the late nineteenth-century period also needs identification. The second half of the nineteenth century has been referred to as a revolution of the Swedish financial market, due to the numerous advancements in scope and scale of the Swedish financial system (for details see Ögren 2010, pp. 1–13). Hence, this period is denoted as the Financial revolution.

In order to avoid the extreme and distortive circumstances of world wars, particularly the high inflation during World War I, the Classical regime is divided into the Early modern banking and Interwar banking periods. This creates the periodisation outlined in Table 1.

At the starting point for the current investigation, there were both unlimited liability banks (ULBs) with the right to issue notes and limited liability banks (LLBs) without that right, as well as the central bank, the Riksbank, which also competed with the privately owned commercial banks. ULB bank notes were redeemable in notes issued by the Riksbank, and the maximum amount of ULB note issuance was related to equity, reserves and credit arrangements with other banks.

According to Jonung (2007 [1988]), however, the reserve requirements of ULBs were never an effective impediment to any over-issue, since they had considerable freedom to choose the composition of their reserves. When Sweden entered the gold standard in 1873, banks had to include gold in their reserves, but this only forced minor adjustments (Jonung 2007 [1988]). Furthermore, even ULBs used

Table 1. *Periodisation*

Period name	Years
Financial revolution	1875–1903
Early modern banking	1904–13
Interwar banking	1919–38
Statist regime	1950–79
Deregulation	1980–94
Market regime	1995–2020
Market regime, BM	1998–2020

Notes: BM = banks and mortgage institutions.

deposits as the main source of funding even before they lost the note-issuing rights with the Bank Act enforced in 1903. However, the fact that ULBs increased their leverage considerably after reform, even compared to LLBs, implies that reserve requirements did have a notable impact on money creation (Ögren and Kenny 2021). This also implies that there was a considerable difference between the possibilities for ULBs and LLBs prior to 1903 in this respect. On the other hand, deposits were not enough to cover the lending by LLBs either, and this condition prevailed even after 1903. For ULBs the deposit deficit was mostly covered by loans on the liability side, while LLBs utilised a variety of sources (Statistics Sweden 2012 [1866–1911]).

Besides reserve requirements, capital requirements on the asset side of the balance sheets was another important pillar of early banking regulation affecting lending capacity. Such requirements were enforced unanimously for all under the Bank Act of 1911, but were relaxed in 1917 (Ögren 2021). The reform also allowed banks to own stocks to a limited extent, and when stocks increased in value so did lending capacity.

Stocks also increased as collateral for extended credit. In 1875 collateral in name (personal confidence) was the most common form of collateral, but was increasingly replaced by collateral first of all in real estate and then in shares (Broberg and Ögren 2019). Urbanisation and incorporation thus increased the available collateral, and thereby credit. This process was further strengthened by institutional changes. For instance, the Joint Stock Company legislation of 1895 abolished the royal approval for incorporation and drastically reduced the minimum capital requirements (Lindgren 2010, p. 104). The financial reforms and the second industrial revolution fuelled by new electrical and chemical 'genius industries' elevated the financial activity in the economy during the late Financial revolution and the Early modern banking periods. The resulting stock market boom was intimately connected to banking activities, which too expanded rapidly.

The 1907 financial crisis was in this respect only a temporary setback, but the crisis in the early 1920s was of a much greater magnitude and led to a ban on banks trading in stocks. The Kreuger crash in the early 1930s exacerbated the regulatory efforts, and

banks were also banned from owning stocks altogether. While World War II induced a command economy with government price and currency controls, the latter kept intact until 1989, the full regulatory regime change, however, only came after the war. The 1950s and 1960s saw a range of new measures, such as tough reserve requirements, penal interest rates, bank liquidity quotas, ceilings for bank lending, regulation for deposits in the Riksbank, bond issue regulation, and duties to invest in treasury and housing bonds (Nygren 1985, pp. 84-5). The consequence was a stagnation in bank lending and borrowing.

Mainly from 1969, reserve requirements became an important tool for the monetary policy of the Riksbank. If funds at the end of the day, after interbank clearance, fell below the reserve requirements, banks had to seek funding from the Riksbank, but with a penalty rate. By manipulating the reserve requirements, the Riksbank could thus relax or tighten monetary policy. Together with higher penalty rates, this was also used in order to raise interest rates on the money market in the wake of currency outflows, which the capital controls were unable to stave off. The highest level was seen in 1979 during the Volcker shock, when bank reserve requirements were set at 8 per cent.

Most of the financial regulations were, however, reversed during the Deregulation period of 1980–95, including the credit ceilings (1985), the capital controls (1989) and the reserve requirements for banks (1994) (Sellin 2018). Particularly the removal of credit ceilings had a dramatic effect on bank lending, greatly contributing to the stock and real estate bubble of the late 1980s. Deposits did not grow in tandem with credit. The burst of that bubble, ending with the currency crisis for the Swedish Krona and its associated interest rate hike in 1992, correspondingly shrank lending by the banks.

The Deregulation period and Market regime were not, however, devoid of new regulation. Internationally, the Basel Accords, with a first version implemented in 1988, imposed successively tougher capital requirements, and domestically in Sweden amortisation requirements for loans collateralised by homes was implemented from 2015. Even so, declining inflation and interest rates pushed bank and mortgage lending to the Swedish general public to record levels towards the end of the period of investigation, raising the fear of financial instability.

The spectre of financial crisis has loomed over the Swedish banking system repeatedly since the 1870s, but in one way or another, the government has always come to the rescue. The response of government, through funds or directly by the central bank, to the behaviour of banks in the face of boom–bust scenarios has, in Chick's terminology, altered money creation from being exogenous to being increasingly endogenous. From 1885 the Riksbank could re-discount private banks' bills of exchange (Fregert 2018, p. 112), and essentially became a bank for other banks. According to Wetterberg (2009, pp. 216–18), the measure was first used during the Baring crisis of 1890. A proper institutionalisation of the lender of last resort function of the Riksbank came after 1903, when banks gained the right to lend against collateral from the Riksbank at a favourable rate. Bailout funds seem to have been an even

more important function during times of financial hardship, however. Ailing banks have been helped or even rescued during most of the banking crises Sweden has experienced since the 1870s. This was the case with Jernvägshypoteksfonden in the late 1870s, Kreditkassan in the early 1920s and Bankstödsnämnden in the early 1990s. Government bodies have also extended highly favourable loans to the banks in distress, including during the Krüger crash and the GFC in 2008/2009.

One reason might be that the too-big-to-fail aspect of Swedish banking has increased over time. While the number of banks, and thus banking competition, increased up to the 1910s, with a few exceptions it declined continually after that, particularly after the weeding out during banking crises. This continuing concentration may also have had a dampening impact on lending itself, in terms of both access and the price of credit (Bonaccorsi di Patti and Dell'Arricia 2004). High competition among banks, on the other hand, has expanded credit, as during the 1910s and the 1980s in Sweden.

Meanwhile, banks have become increasingly intermingled via both systemic risks associated with aggregate credit and asset markets, as well as via the interbank clearing mechanism, pioneered by Stockholm's Enskilda Bank's formation of an interbank clearing system for postal bank bills (*postremissväxlar*) in 1856. This too should have increased the endogenous element of bank money creation, according to Chick.

Moreover, this endogeneity increasingly took an international form during the Market regime, as an increasing share of mainly of real estate loans was funded on international money markets rather than via deposits (Swedish Bankers' Association 2020). This internationalisation also introduced the use of covered bonds, securitisation and derivatives in funding loans, by which the boundaries of conventional banking were abandoned.

<div align="center">III</div>

The sources on Swedish historical bank statistics are rich, with minute data on the balance sheets for all Swedish commercial banks since 1866. From 1866 to 1874, the data are quarterly, but starting from January 1875, the data appear on a monthly basis, reported to the Bank board at the Swedish treasury department (Statistics Sweden 2012 [1866–1911]). The reported figures are taken at face value, although there may have been incentives for banks to juggle the accounts, particularly during distress, for instance by postponing credit losses. Not least since the banking supervision could revoke bank charters, this problem is deemed unsystematic and of lesser importance. Furthermore, extended credit may not always have ended up as deposits, especially during the Financial revolution period, but may rather have been kept as cash.

From January 1912 and until December 1996 the data are from the bank summaries of the royal bank inspection (the agency, which became independent in 1907, changed name numerous times during the twentieth century, and merged with the insurance inspection board in 1991 to form the financial inspection board) (Kungl.

Bank- och fondinspektionen 1912–53; and 1954–67; Kungl. Bankinspektionen 1968–83; Bankinspektionen 1985–94; Finansinspektionen 1995–6). From January 1997 to December the same year, the data are from Riksbanken (1996–7), and from January 1998 the data are from the online database of Statistics Sweden (2021).

Large savings banks and foreign bank branches are included in the data from December 1993, and from January 1998, lending to non-EU monetary financial institutions is included. Mergers and acquisitions among banks affect the total if the deal occurs between Swedish commercial banks and other types of banks. The largest such deal occurred in 1974 with the merger between *Postbanken* and *Kreditbanken*. *Postbanken* was not a commercial bank, but from June 1974 it is included in the commercial bank summaries, creating a break in the series.

Ideally, disaggregation into different types of loans and deposits would differentiate the interaction between them (see e.g. Kashyap *et al.* 2002). This would, however, require a considerably larger investigation beyond the scope of this article, the aim of which is to compare aggregates over times. Furthermore, reported items change over time in the sources. Entries are merged or split, and sometimes new entries appear in the accounts, though they are small in significance and size. Both deposits and loans comprise accounts with different accessibility, maturity, liquidity and restrictions regarding amounts. From January 1987 there is no longer any disaggregation in the summaries. Thus, for the sake of consistency, comparability, and the possible reach of this article, only the sum total values of borrowing and lending are reported in the dataset.

It is important to note that commercial banks have been neither the only banks nor the only credit providers in general in Sweden historically. Some of these have disappeared, such as the so-called locally organised *filialbanker* and *folkbanker*. Savings banks, *sparbanker*, community-based and non-profit by nature, formed from the 1820s, thrived well into the twentieth century, as did the lesser group of farming association banks, *jordbrukskassor*, introduced in 1915. Reforms in 1955 and even more so in 1969 harmonised banking law so that *sparbanker* and *jordbrukskassor* came to be treated on equal footing with the commercial banks. In any case, commercial banks have been the largest group of banks by far (Ahnland 2015).

Furthermore, rural mortgage credit associations played an important role in agricultural finance during most of the nineteenth century, and urban mortgage credit associations were active on the urban real estate market mainly from the early twentieth century. Insurance companies also engaged in the credit market to a considerable degree at the end of the nineteenth century, but less so during the twentieth century, and from the 1950s *finansbolag* constituted a diverse group of creditors primarily targeting consumer credit. In response to the promotion of housing credit during the 1950s, bank-owned bond-emitting housing mortgage institutions grew in importance, with insurance and pension funds being the main buyers, but as they have generally operated separately from the bank balance sheets their lending has mainly been left out of this investigation (this is still the case for three of the major banks).

This separation poses somewhat of a methodological challenge for the current study: some bank deposits have been lent by the parent banks to the mortgage institution subsidiaries, covering lending to the general public but outside the balance sheets of the banks proper. While such finance only amounted to a small percentage of all lending from mortgage institutions during the housing boom from the mid 1950s to the 1970s, it grew in importance, particularly during the 2010s. In 1998, bank loans accounted for some 10 per cent of housing mortgage institution lending, but by 2020 the two forms of mortgage institution financing – bank loans and bonds – were almost equal in size (Statistics Sweden 2022a). This can explain the large deposit surpluses of Swedish banks mainly from 2015. Banks also emitted bonds in order to finance their lending to mortgage institution subsidiaries.

Banks have also increasingly relied on bonds themselves for financing their lending, not least covered bonds. Since 1998 the ratio of emitted securities to deposits increased from 20 to 40 per cent (Statistics Sweden 2022a). Traditionally this kind of finance has bridged a deposit deficit, and it continued to do so to a certain extent also after 1998, especially between late 2006 and early 2015. All in all, this increasing integration of banking and housing mortgage institutions in recent decades calls for aggregation of the two. Thus, for the Market regime in 1995–2020, the investigation of the relationship between credit and deposits is complemented with an examination of the relationship between credit on the one hand and deposits and bonds on the other, in 1998–2020 (for which there is data).

In order to be able to consider a more detailed analysis when possible, ULBs and LLBs are investigated both separately and aggregated, during the Financial revolution in 1875–1903. The data on credit and deposits are displayed in Figure 1, as natural logarithms of the original values.

Drawing on the literature (e.g. McLeay *et al.* 2014), two control variables are introduced into the analysis: the main policy interest rate of the central bank, and GDP. Low interest rates mean cheaper money and are thus associated with a higher demand for credit. GDP is positively correlated with income and collateral generated by wealth and negatively with credit risk. Other relevant variables discussed in the current study are bank market competition/concentration, inflation and even the value of real estate and shares as sources of collateral, but lack of monthly data on these variables prevents their inclusion in the study. Monthly data on the interest rate are obtained from Waldenström (2014), available for the whole period (data after 2012 have been updated by Waldenström after publication). Monthly data on GDP rely on the proxy of an index of industrial production, only available since 1913 from Hegelund (2020), and used in regressions from 1919, linked to the Statistics Sweden data on a monthly GDP indicator since 2012 (2022b). To be sure, as a proxy, the Hegelund (2020) data are not optimal and should be treated with caution, but they are the best data available.
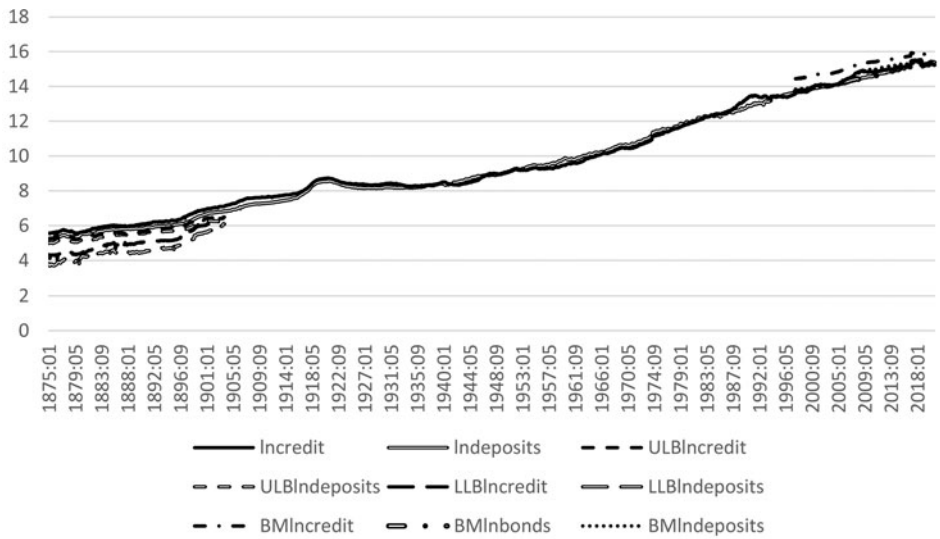
Figure 1. *Lending and borrowing, monthly 1875–2020*
Source: see the text.

IV

The methodology for data compilation is outlined in the previous section, and this section focuses on the methodology for the second aim of the study – testing exogeneity and endogeneity of the monetary system of Sweden throughout the period of investigation. This testing is operationalised via cointegration, estimation of long-run coefficients and impulse-response functions (IRFs).

In order to test the long-run relationship between deposits and credit, the Johansen cointegration methodology is used. Before such tests are performed, however, unit root tests are employed, but not reported, in order to determine whether the variables are stationary or not. The details of these procedures are available in the Appendix.

The target variables credit, deposits and finance are transformed into natural logarithms in order to reduce heteroscedasticity and other residual non-normality, denoted lncredit, lndeposits, and lnfinance in the results. For ULBs this becomes ULBlncredit and ULBlndeposits, for LLBs it becomes LLBlncredit and LLBlndeposits, and for banks and mortgage institutions BMlncredit and BMlnfinance. GDP is also logarithmised.

The cointegration tests, and the associated tests for lag lengths, serial correlation and non-normality are not reported in tables. Long- and short-run coefficients are, however, reported for target variables (not control variables), mostly in order to identify significant coefficients. For interpretation of long-run coefficients, their sign has to be reversed.

Identification of the dependent variable in the long-run equation is guidance by theory, whereby the assumed dependent variable is normalised to one. In this study, the two opposing theories are exogenous and endogenous money, and

hence credit and deposits are each treated as dependent long-run variables in opposing models.

The IRFs are the main instrument of analysis. They indicate the predictive power of one variable over time on another variable, so-called Granger causality. In the case at hand, this means that the response in deposits from a change or impulse in credit, and vice versa, can be estimated on a monthly frequency. Bank balance sheets of assets and liabilities have had to balance in each monthly report submitted to the monitoring authority. Intrabank clearing and possible associated monetary endogeneity within a month may hence not be visible in these data. Even so, discrepancies at the aggregate level over time could show that alternative means of funding have had to be employed when credit extended has not been covered by deposits, for instance foreign lending, bond issuance or government funding via re-discounting, open market operations or bail-out funds during times of financial distress. This could be a sign of endogeneity. On the other hand, if deposits have occurred before credit, it may be a sign that the savings of the general public predate their borrowing, implying money exogeneity.

V

In this section, the econometric tests are accounted for and discussed. The results from the unit root tests, unreported in tables, confirm that the target variables (all versions of lncredit, lndeposits and lnfinance) contain unit root when in levels but are stationary when in first differences, as unit root is rejected at least at the 5 per cent level of significance, for all periods. The control variables are stationary in first differences as well during all periods (and sometimes stationary in levels). Also unreported, the Johansen test for cointegration tests confirm cointegration in all models, at least at the 5 per cent significance level, which means it is valid to estimate long-run coefficients and IRFs. Associated and unreported tests for lag serial correlation and non-normality show that neither model suffers from serial correlation, but that all of them suffer from non-normality. Lag length obtained for each model, which differs considerably, is reported with the long-run coefficients (see Tables 2–3).

The long-run coefficients of lndeposits when lncredit is the dependent variable, and lncredit when lndeposits is the dependent variable, are significant in the majority of cases. This is the case for the models for the 1875–1903 Financial revolution, when the long-run coefficients are of similar magnitude around unity regardless of whether lncredit or lndeposits is the dependent variable, and regardless of whether unlimited of limited liability banks are considered. For the 1904–13 era of Early modern banking, however, only with the regression where lncredit appears as the dependent variable is the target independent variable – in this case lndeposits – significant, with a fairly large coefficient. For the Interwar era, in 1919–38, both lncredit and lndeposits are significant when they appear as independent variables, though of different magnitude. Contrarily, for the highly regulated era of the Statist regime in 1950–79, neither of the variables is statistically significant when appearing as the independent variable. The Deregulation period of 1980–1995 displays coefficients that are very

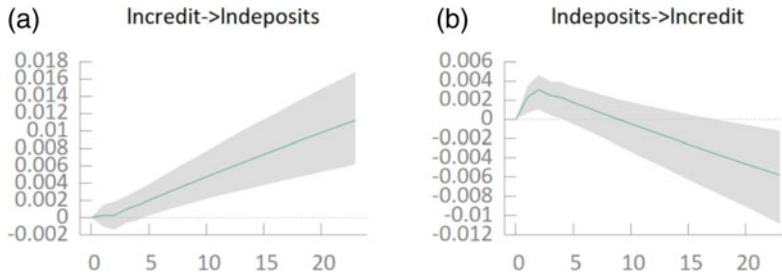Table 2. *Variants of lncredit as dependent variable, long-run coefficients*

| Dependent variable	1875–1903 lncredit	1875–1903 ULB lncredit	1875–1903 LLB lncredit	1904–13 lncredit	1919–38 lncredit	1950–79 lncredit	1980–94 lncredit	1995–2020 lncredit	1998–2020 BM lncredit
Lag structure	3	3	3	3	9	17	3	15	22
lndeposits	-0.980***			-2.615***	-0.571**	-0.047	-0.570***	-3.826	
	(0.031)			(0.581)	(0.212)	(0.692)	(0.106)	(2.642)	
ULBlndeposits		-1.015***							
		(0.053)							
LLBlndeposits			-1.184***						
			(0.092)						
BMlndeposits									0.477
									(0.556)
BMlnbonds									-6.463***
									(1.551)

Notes: EB = *enskilda banker*. AB = *aktiebanker*. BM = banks and mortgage institutes. Significance as ★ = <0.05; ★★ = <0.01; ★★★ = <0.001.

Table 3. *Variants of lndeposits as dependent variable, long-run coefficients*

Dependent variable	1875–1903 lndeposits	1875–1903 ULB lndeposits	1875–1903 LLB lndeposits	1904–13 lndeposits	1919–38 lndeposits	1950–79 lndeposits	1980–94 lndeposits	1995–2020 lndeposits	1998–2020 BM lndeposits
Lag structure	3	3	3	3	9	17	3	15	22
lncredit	-1.021*** (0.030)			-0.382 (0.230)	-1.751*** (0.525)	-21.113 (12.086)	-1.754*** (0.190)	-0.261 (0.901)	
ULBlncredit		-0.985*** (0.051)							
LLBlncredit			-0.845*** (0.078)						
BMlncredit									0.997 (1.764)
BMlnbonds									-7.757*** (2.110)

Significance as ★ = <0.05; ★★ = <0.01; ★★★ = <0.001.

Figure 2. *IRF 1875–1903*

Figure 3. *IRF 1875–1913*

Figure 4. *IRF 1919–38*
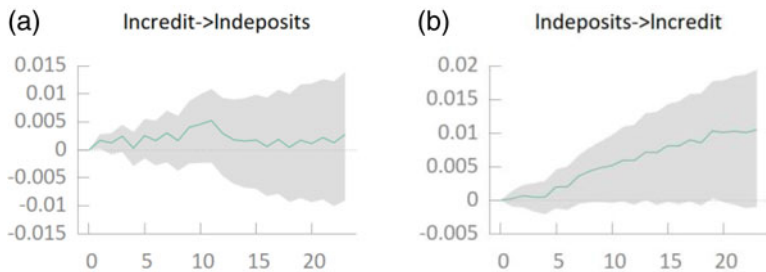
Figure 5. *IRF 1950–79*
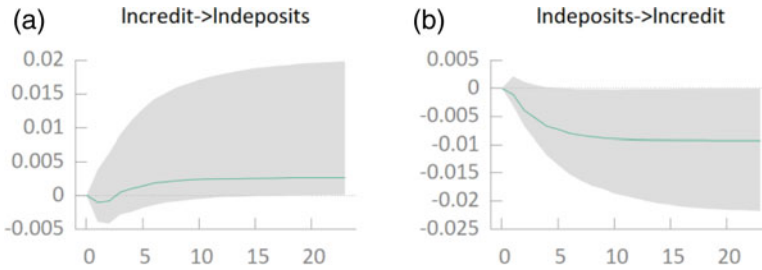
Figure 6. *IRF 1980–94*

Figure 7. *IRF 1995–2020*

similar to those for the interwar period. During the most recent era, the Market regime in 1995–2020, again neither of the variables displays significant coefficients when appearing as the independent variable, but when BMlncredit, BMlndeposits and BMlnbonds (data for banks and mortgage institutions aggregated) are regressed in 1998–2020, lnbonds is positive and significant in both models while neither of the other two variables is.

However, correlation is not causation, and for the latter it is more meaningful to analyse IRFs rather than coefficients. In Figures 2a, 3a, 4a, 5a, 6a and 7a, the responses in lncredit from an impulse in lndeposits are depicted. This reflects the hypothesis that deposits generate credit, and that money is exogenous. The responses in lndeposits from an impulse in lncredit are depicted in Figures 2b, 3b, 4b, 5b, 6b and 7b, reflecting the hypothesis that credit generates deposits, and that money is endogenous. Figures 8a and 8b, and 9a and 9b, show the IRFs of the corresponding interactions but only for ULBs and LLBs respectively, in 1875–1903. Figures 10a and 10b display the IRFs reflecting the interactions between lncredit and lndeposits for aggregated banks and mortgage institutions (denoted as BMlncredit and BMlndeposits) in 1998–2020, once controlled for lnbonds, in addition to lnGDP and the interest rate.

In general, the results from the IRFs seem to favour the endogenous money view slightly more often than the loanable funds view, although they are far from unanimous across the periods studied. In the case when lncredit is the independent variable and lndeposits the dependent variable, both the upper and lower 10 per
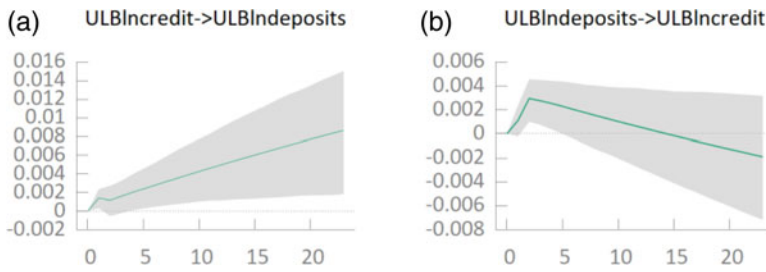
Figure 8. *IRF 1875–1903*
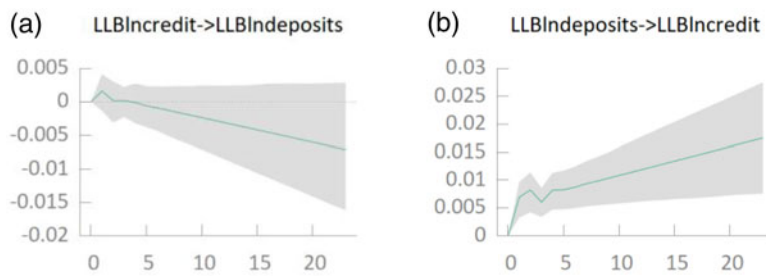
Figure 9. *IRF 1875–1903*
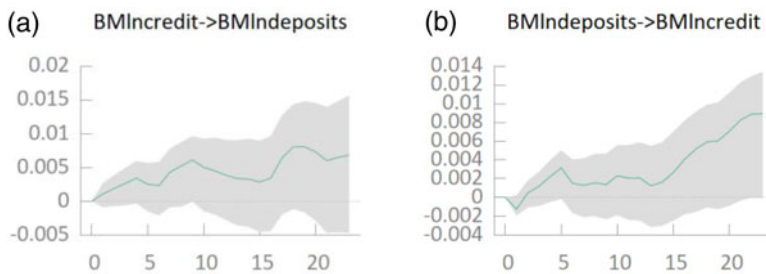
Figure 10. *IRF 1998–2020*

Notes: Figures 2a–10b: the y-axis denotes standard errors and the x-axis denotes months. Grey area equals 90 per cent confidence interval and dark coloured line equals point estimate.

cent confidence bands exceed zero at some point during the estimated 24 months (sometimes just barely) in all periods. The same can be said about the 1875–1903 period when only ULBs are examined (Figure 8a). When lndeposits is the independent variable and lncredit the dependent variable, the confidence bands are significant at some point in the IRFs during the 1875–1903 (Figure 2b), 1919–38 (Figure 4b) and 1950–79 periods (Figure 5b), as well as when both ULBs (Figure 8b) and LLBs

(Figure 9b) are examined separately. This indicates that in many cases, the displayed Granger causality is bidirectional and it is impossible to answer which came first, 'the chicken and the egg'. This is the case in 1875–1903, 1919–38, 1950–79 and for ULBs in 1875–1903, implying that most of the time it may be impossible to decide whether loanable funds or endogenous money theory is the most correct theory historically in Sweden.

In some cases, however, this is not the case. The IRFs imply that the interactions between lncredit and lndeposits were very different between ULBs and LLBs during the Financial revolution in 1875–1903. While the IRFs for ULBs (Figures 8a and 8b) give firmer evidence for the endogenous hypothesis that credit gives rise to deposits – at least over a longer time span of months, the opposite hypothesis of loanable funds has more traction for LLBs during this period (Figures 9a and 9b). LLBs had to rely more on attracting deposits from the general public when funding their lending activities, while ULBs could print money themselves, though they too relied mainly on deposits for funding and had to comply with legal reserve requirements to some extent. Endogenous money theory seems to be the more relevant theory in 1904–13, however, possibly because of the institutionalised lender of last resort role of the central bank, and/or greater freedom for banks to lend against collateral in shares. This is also valid for the Interwar banking era of 1919–38.

During the Market regime, when bonds are thrown into the mix and both banks and mortgage institutions are aggregated, there is support for neither the endogenous nor the exogenous view, as neither IRFs exceed the lower zero confidence band, although they are close. This may be seen as an indication that deposits have become less important both as a pool of loanable funds as well as being an important result of credit extension.

VI

The dataset presented in this article is, to the best of the author's knowledge, the longest monthly time series dataset on monthly credit and deposits to date, spanning 146 years with 1,752 monthly observations, on an aggregate level for all Swedish commercial banks. The dataset is completely balanced, meaning that there are no observational gaps in the data. Reported categories of lending from and borrowing by commercial banks to/from the general public has from time to time changed somewhat in the balance sheets, but the sums total are consistent over time. Types of deposits include, for instance, giro and chequing accounts, savings accounts and depository accounts. Major sources of credit are foreign bills of exchange, current credit accounts and loans due to different types of collateral. In addition there are some minor loan categories.

The second aim of this article, to assess to what extent money may be considered exogenous or endogenous in Sweden during the period as a whole as well as during different subperiods identified in the study with the help of the literature, is a first application of the dataset presented in the article. The results from the econometric tests do not pose unanimous support for either view – rather the evidence suggests

that credit and deposits have mostly interacted in mutual feedback during the history of Swedish of banking since 1875. Even so, for certain periods and for certain types of banks, there is more support for one theory over the other: while endogenous money theory seems to have been more relevant for ULBs during the Financial revolution in 1875–1903, loanable funds theory seems more appropriate for LLBs during this era. It has not been possible to control for GDP in this case though. The lack of significant long-run coefficients along with barely significant IRFs particularly for the Statist regime may be an indication of the strong influence of various regulations on the credit market.

It is notable that during the Market regime in 1995–2020, the evidence speaks for the endogenous view when only deposits and credit are considered. However, when credit and deposits with both banks and mortgage institutions are more realistically included from 1998, along with bonds from the same, the results indicate that deposits become less important both as a source and as a result of credit. Bonds, especially covered bonds, became more important for creditors as a source of funding, and as the general public increasingly turned to mutual funds, deposits lost significance as a vehicle for savings.

Even so, some historical events still speak for the endogenous view. During the Deregulation and Market regime periods, banks were bailed out both during the crisis of the early 1990s and in 2008–9. Arguably, this reduced the perceived market risks for banks and effectively lowered their funding costs, in turn lowering customer interest rates and raising demand for loans with the general public. Furthermore, deregulation liberalised bank balance sheets. Their managements were freed from reserve requirements, capital controls and other government interference and became instead subject to financial innovation and internationalisation, in the way described by Chick (1992, pp. 193–205).

The evolutionary approach applied by Chick (1992, pp. 193–205) to the British monetary system is in this study tested on the case of Sweden since 1875. Overall, the results of this study do not support the theory that a monetary system with private commercial banks may evolve from exogenous money creation, where deposits give rise to credit, to endogenous money creation, where credit extended by banks creates deposits. Rather, the evidence suggests that even if there is somewhat more support for the endogenous money view, the interaction between credit and deposits has in general been almost impossible to identify as either endogenous or exogenous during most regulatory regimes in Sweden since the inception of a modern banking system in the 1870s. Moreover, both theories often hold validity simultaneously. The evidence is thus far from unanimous, and should be treated with a healthy grain of salt, given the flaws in the sources and in the methodology. Even so, the results may provide non-trivial guidance as to how deposits and credit have interacted over the long run in Swedish commercial banking history.

Supplementary material

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Appendix

This appendix contains methodological details of the econometrics used. The Johansen test is generally employed with non-stationary time series, which also need to be stationary in first differences, but occasionally systems with both non-stationary and stationary variables in levels are considered as well. In line with Lütkepohl and Krätzig (2004, p. 89) the concept of cointegration is extended by including any linear combination that is stationary.

The Augmented Dickey–Fuller test is the most common unit test, and it is performed on both variables in levels as well as in first differences, with constant and trend. Lag length is determined with the help of the Akaike Information Criterion (AIC) with seasonal dummies and a maximum lag length of 24 months, equal to two years, in line with Woolridge (2009, p. 633).

If the variables are appropriate according to the unit root tests, it is possible to proceed with cointegration tests. The Johansen test is based on a vector autoregression (VAR) system in which all variables are regarded as endogenous. As with the ADF test, the VAR lag specification is being controlled for seasonal dummies. In order to make a coherent analysis it is necessary to be able to compare each model. Lag selection is determined in the same way as for unit root tests, but if serial correlation is still detected by an LM test (with a Rao F statistic), additional lags are added incrementally until serial correlation is insignificant. Non-normality is not considered as particularly problematic since the Johansen test is reasonably robust to this (Cheung and Lai 1993), and since the successive IRFs have boot-strapped confidence intervals that are not dependent on normality. However, non-normality, tested with a Doornik-Hansen (Chi-square) test, does mean that coefficients and their t-statistics and p-values might be taken with a grain of salt. The results of these tests show that all but one regression is free from serial correlation, but that all suffer from non-normality. The regression with data on banks and mortgage institutions aggregated during the Market regime in 1998–2020 contains significant serial correlation from the tenth lag, a problem which cannot be remedied with the inclusion of additional lags. The results obtained from this regression must thus be treated with caution, even considering the high lag order.

Cointegration is detected if the residuals of an equation involving non-stationary variables are themselves stationary, which means that the variables share a common trend. Johansen's method is to estimate the coefficient matrix from a VAR and to test if it is possible to reject the restrictions implied by the reduced rank of the said coefficient matrix. If rank zero is rejected, there is at least one independent linear combination between all the variables that is stationary, indicating cointegration. Since the interest rate and GDP are considered to be control variables, the study concerns one cointegrating relationship, which is why only rank zero is tested.

The common trend might take different forms, and may include a constant or linear trend. The procedure for choosing trend specification is the Pantula principle, by which specifications are tested successively from the least restrictive to the more restrictive, stopping whenever a significant trace statistic is reached.

If cointegration is confirmed, the VAR is transformed into first difference form with error correction coefficients for the detected long-term relationship in each equation, resulting in a VEC model. Since all models exhibit non-normality in the residuals, and since the coefficients of the VEC models lack robust

standard errors, these are not reported. From the VEC models it is, however, possible to derive IRFs with boot-strapped confidence intervals, in which a response in one variable from an impulse in another is displayed graphically over time, in this case over 24 months. The estimated IRFs are significant if the whole confidence interval is above or below zero.